Electromagnetic energy transport through metallic nanoparticle arrays

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We investigate electromagnetic (EM) energy transport through arrays consisting of sub-wavelength sized Au spheres, with the Finite Difference Time Domain (FDTD) method. We assume the Drude model for the dielectric function of the Au nanospheres. The Drude model is incorporated into the FDTD technique with the introduction of an appropriate time-dependent polarization current. This method is known as Auxiliary Differential Equation (ADE) method [1]. We first focus our study on the EM excitations on single metallic nanoparticles. A comparison with Mie theory shows an overall good agreement between the two methods [2]. We use a localized dipole like source at the frequency of the single scatterer resonance to excite the EM modes along the nanoparticle array. We consider both longitudinal as well as transverse EM excitations. We verified numerically the EM energy transfer through the Au nanochain, for both polarizations. Nonetheless, a careful analysis of the field profiles suggests that nearest-neighbor tight-binding like models fail to describe certain aspects of the observed EM energy transport through the nanochain.

[1] ``Computational Electrodynamics'' A. Taflove, S. C. Hagness, Artech House, Boston (2000). [2] ``Electromagnetic excitations on single metallic nanoparticles,'' S. Foteinopoulou, J.-P. Vigneron and C. Vandenbem, unpublished.